

# Tinnitus Measurement in Humans

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# Keeping Things Legal

- Financial disclosure: most studies nonindustry-funded; some industry-funded; no personal financial COI
- The opinions expressed do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government

# Purpose

- Can't directly measure tinnitus
  - Henry JA. “Measurement” of Tinnitus. *Otology and Neurotology* 37(8):e276-85, 2016.
- Purpose: Describe methodologies for the clinical assessment of patients and research participants who report tinnitus

# Overview

1. *AAO-HNSF Clinical Practice Guideline: Tinnitus*
2. Categories of Tinnitus
3. “Measurement” of Tinnitus
4. Clinical Recommendations

# 1. AAO-HNSF *Clinical Practice Guideline: Tinnitus*

# AAO-HNSF *Clinical Practice Guideline*

Tunkel D, Bauer C, Sun G, Rosenfield R, Chandrasekhar S, Hussey H, Archer SM, Blakely B, Carter J, Granieri E, Henry JA, Hollingsworth D, Khan FA, Mitchell S, Monfared A, Newman C, Omole F, Phillips CD, Robinson S, Taw MB, Tyler R, Waguespack R, Whamond E. Clinical practice guideline: tinnitus. *Otolaryngology – Head and Neck Surgery* 151(2S) S1-S40, 2014.

***The AAO-HNSF tinnitus clinical practice guideline is currently the most comprehensive guide to evidence-based clinical services for tinnitus management***

# AAO-HNSF

## *Clinical Practice Guideline: Tinnitus*

- *American Academy of Otolaryngology–Head & Neck Surgery Foundation*
- 23-member guideline development group
- Systematic review of peer-reviewed literature
- Addressed 3 broad domains: assessment, intervention/management, and education
- *“The first evidence-based clinical guideline developed for the evaluation and treatment of chronic tinnitus”*

# Three Broad Domains Considered in Tinnitus Guideline Development

- Assessment
- Intervention/Management
- Education

# Assessment: Relevant Questions to Guideline Development Group

- *How should patients who first present with tinnitus be evaluated?*
- *What is the initial evaluation of patients with:*
  - *Recent-onset tinnitus?*
  - *Persistent tinnitus?*
- *Should all patients with tinnitus have an audiologic evaluation?*
- *Which patients with tinnitus require diagnostic tests and evaluation?*

# Assessment: Relevant Questions for Guideline Development Group (cont.)

- *How should patients distinguish bothersome tinnitus from nonbothersome tinnitus?*
- *What are the best methods/instruments for evaluating the severity of tinnitus and the effects of treatment?*
- *How should patients be triaged according to tinnitus severity?*

# AAO-HNSF *Recommendations for Assessment*

- ✓ History and physical exam (ENT)
- ✓ Audiologic exam (if: tinnitus  $\geq 6$  mo, unilateral; HL)
- ✓ Distinguish:
  - ✓ Bothersome vs. nonbothersome tinnitus
  - ✓ If bothersome: persistent ( $\geq 6$  mo) vs. recent-onset
- ✓ Educate patients re: treatment options
- ✓ Hearing aid evaluation (if warranted)
- ✓ Cognitive-Behavioral Therapy – CBT (if intervention needed)

# AAO-HNSF

## *Recommendations Against*

- ⊘ Imaging studies (most patients)
- ⊘ Drugs (antidepressants, anticonvulsants, anxiolytics, intratympanic medications)
- ⊘ Dietary supplements (ginkgo biloba, melatonin, zinc, etc.)
- ⊘ Transcranial magnetic stimulation – TMS

# AAO-HNSF

## Options

- Audiologic exam
- Sound-based therapy



## 2. Categories of Tinnitus

# Primary vs. Secondary Tinnitus

- **Primary**
  - Idiopathic
  - May or may not be associated with SNHL
- **Secondary**
  - Associated with a specific underlying cause (other than SNHL) or an identifiable organic condition
  - *Somatosounds/somatic tinnitus?*
  - *“Objective” tinnitus?*

# Temporal Categories of Tinnitus

## Clinical Implications

- **Spontaneous**

- Transient ear noise

Normal phenomenon

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- **Temporary**

- Associated with specific event

- **Occasional**

- Every few weeks/months

Educate and monitor as appropriate

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- **Intermittent**

- Every day/week

- **Constant**

Audiologic evaluation

# Duration/Longevity of Tinnitus

- **Persistent** ( $\geq 6$  mo)
  - “Chronic”
- **Recent-onset** ( $< 6$  mo)
  - “Acute”

## Tinnitus Screener

Tinnitus is ringing, buzzing, humming or other noises in your ears or head.

During the PAST YEAR:

<p>1. Have you experienced tinnitus lasting more than 2 - 3 minutes?</p> <p><input type="radio"/> NO: <u>STOP HERE</u></p> <p><input type="radio"/> YES: GO TO #2</p>	<p>No Tinnitus ←</p>
<p>2. Have you experienced tinnitus for at least 6 months?</p> <p><input type="radio"/> NO: GO TO #3</p> <p><input type="radio"/> YES: GO TO #3</p>	<p>Acute Tinnitus ←</p> <p>Chronic Tinnitus ←</p>
<p>3. In a quiet room, can you hear tinnitus?</p> <p><input type="radio"/> Always: <u>STOP HERE</u></p> <p><input type="radio"/> Usually: <u>STOP HERE</u></p> <p><input type="radio"/> Sometimes/Occasionally: GO TO #4</p>	<p>Constant Tinnitus</p> <p>Constant Tinnitus</p>
<p>4. When you heard tinnitus this past year, was it caused by a recent event? (Examples: loud concert, head cold, allergies, some medications)</p> <p><input type="radio"/> NO: GO TO #6</p> <p><input type="radio"/> YES, Sometimes: GO TO #5</p> <p><input type="radio"/> YES, Always: GO TO #5</p>	<p>Temporary Tinnitus</p>
<p>5. Does your tinnitus seem to "come and go" on its own, in addition to being caused by a recent event(s)?</p> <p><input type="radio"/> NO: <u>STOP HERE</u></p> <p><input type="radio"/> YES: GO TO #6</p>	<p>Temporary Tinnitus</p>
<p>6. Do you experience tinnitus on a:</p> <p><input type="radio"/> Daily or weekly basis: <u>STOP HERE</u></p> <p><input type="radio"/> Monthly or yearly basis: <u>STOP HERE</u></p>	<p>Intermittent Tinnitus</p> <p>Occasional Tinnitus</p>

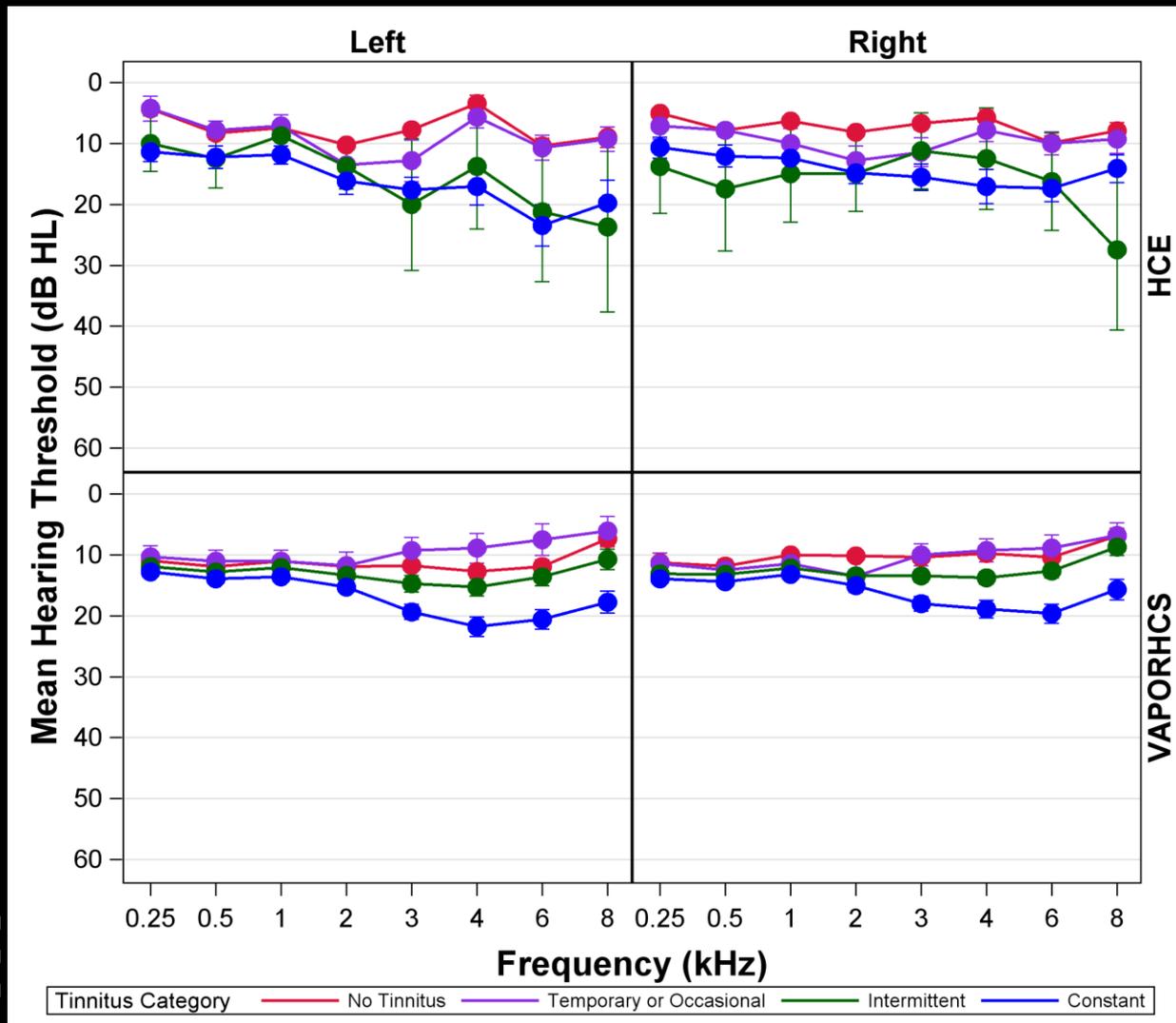
Spontaneous

Recent-onset

Persistent

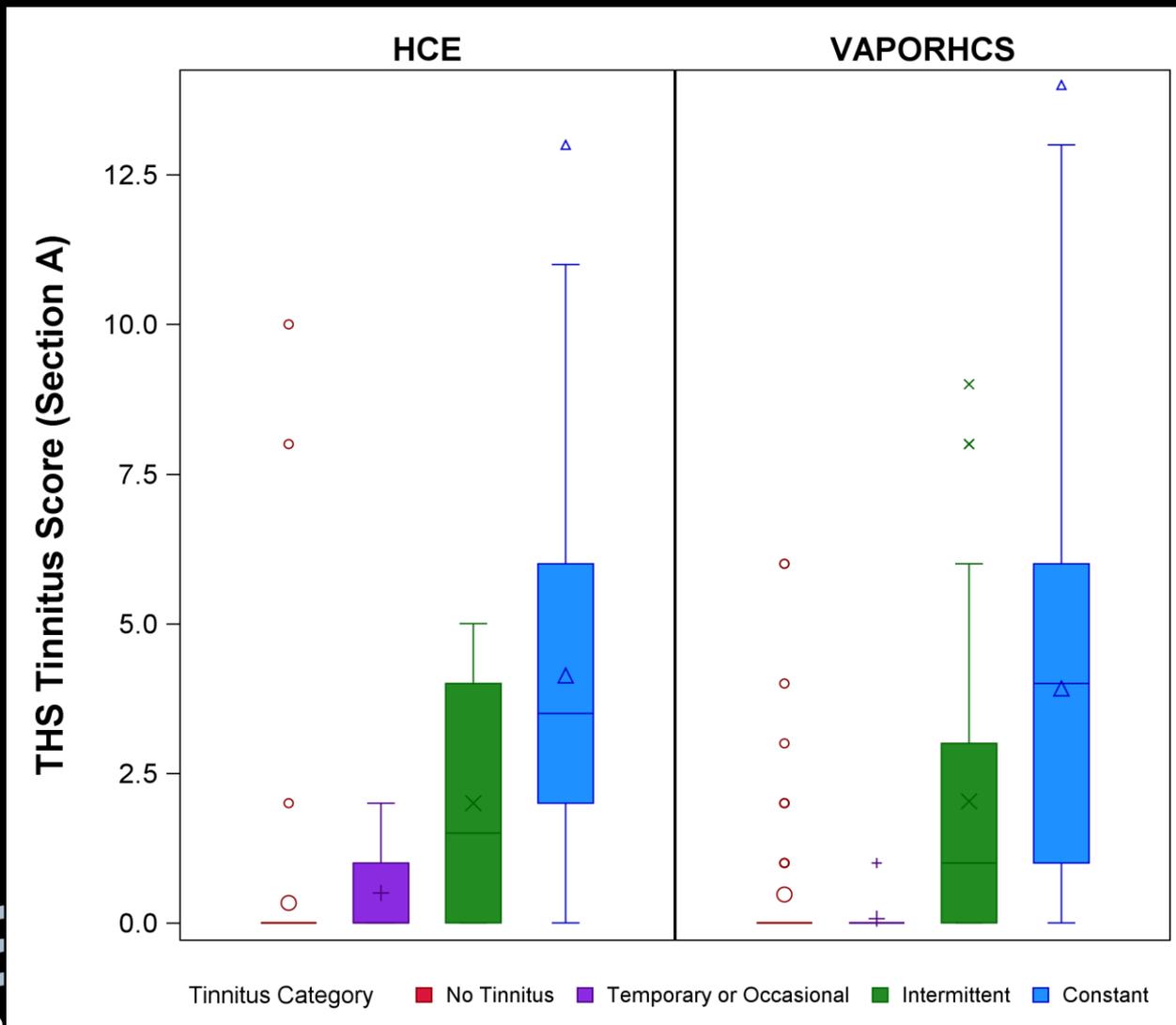
Henry JA, Griest S, Austin D, Helt W, Gordon J, Thielman E, Theodoroff SM, Lewis MS, Blankenship C, Zaugg TL, Carlson K. [Tinnitus Screener: Results from first 100 participants in epidemiology study.](#) *American Journal of Audiology.* 25(2):153-60, 2016.

# Mean Hearing Thresholds for 4 Categories: Constant, Intermittent, Temporary/Occasional, No Tinnitus



Henry JA, Thielman EJ, Griest SE, Blankenship C, Madden BK, Gordon J, Helt WJ, Hecht Q, Okungbowa-Ikponmwoosa A, Melgoza R. "The Tinnitus Screener: Data from 350 Research Participants." NCRAR Biennial Conference, October 5, 2017. (poster)

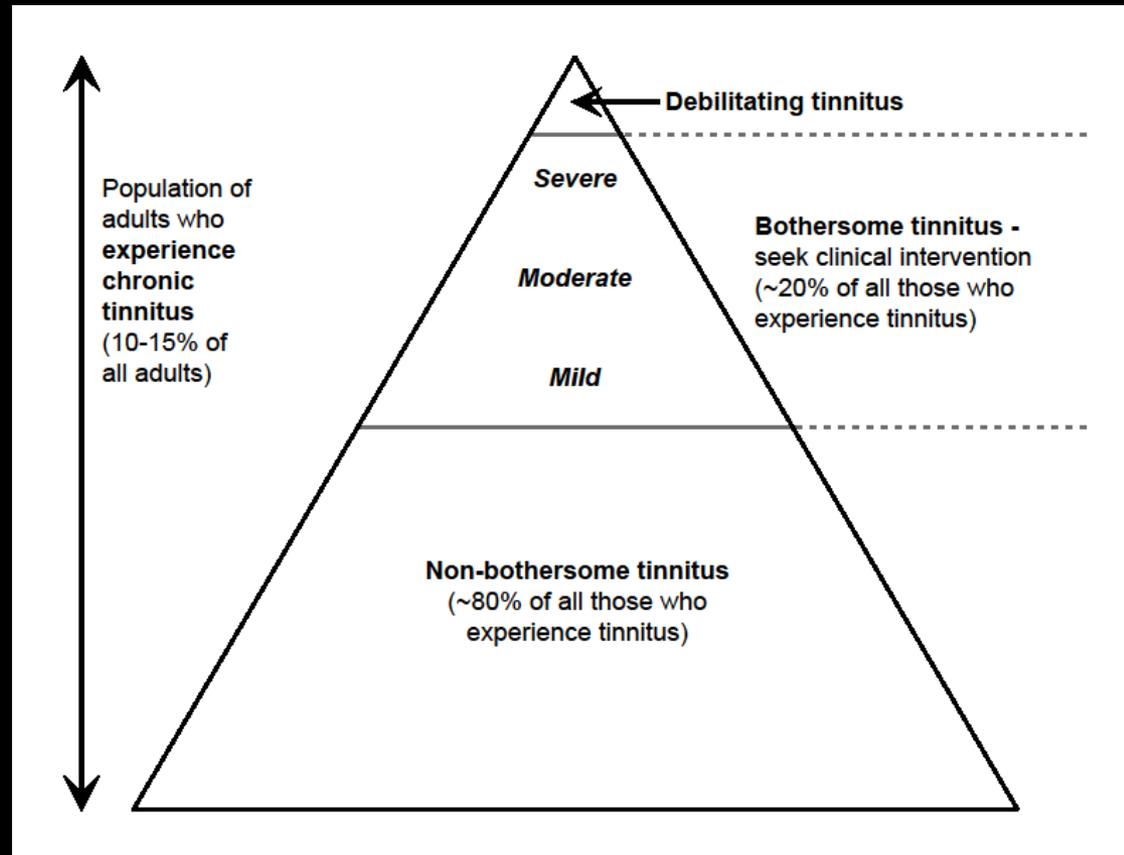
# Boxplot of Tinnitus and Hearing Survey (THS) Section A scores by tinnitus category and site



Henry JA, Thielman EJ, Griest SE, Blankenship C, Madden BK, Gordon J, Helt WJ, Hecht Q, Okungbowa-Ikponmwoosa A, Melgoza R. "The Tinnitus Screener: Data from 350 Research Participants." NCRAR Biennial Conference, October 5, 2017. (poster)

# Impact of Tinnitus

- **Nonbothersome**
- **Bothersome**
  - Mild
  - Moderate
  - Severe
  - Debilitating



# Other Tinnitus Attributes

- **Loudness** (0-10 scale)
  - Loudness **fluctuations** (frequency, intensity)
- **Pitch** (low, medium, high)
- **Spectral quality** (tonal, noisy, other)
- **Number of sounds** (1, 2, 3....)
- **Lateralization** (unilateral, bilateral, symmetric, asymmetric, in head, out of head)

# *How Does Sound Affect the Tinnitus?*

- **Maskability** (suppression)
  - Easily masked → not maskable
- **Modification/modulation**
- **Residual inhibition (RI)**
  - None → partial → total
- **Exacerbation**



# 3. “Measurement” of Tinnitus

# Interventions for Tinnitus Target:

- **The perception of tinnitus**
  - Attempt to reduce tinnitus loudness/intensity
  - “Measured” by psychoacoustic tests
- **Reactions to tinnitus**
  - Various domains of tinnitus impact, such as emotional distress, concentration difficulties, reduced sense of control, sleep disturbance, and others
  - “Measured” by questionnaires

# Measuring Tinnitus *Perception*

# A “Cure” Would Eliminate the Perception of Tinnitus

- A “partial cure” would reduce the perception of the dominant tinnitus sound, by reducing its loudness (intensity/magnitude)

# Psychoacoustic Assessment Battery

- Over 35 years ago the Ciba Foundation in London promoted a standardized protocol for clinical tinnitus assessment
- Recommended a psychoacoustic assessment battery:
  - Pitch matching
  - Loudness matching
  - Minimum masking level (MML)
  - Residual inhibition

## 35 Years Later: AAO-HNSF Statement Re: Psychoacoustic Testing of Tinnitus

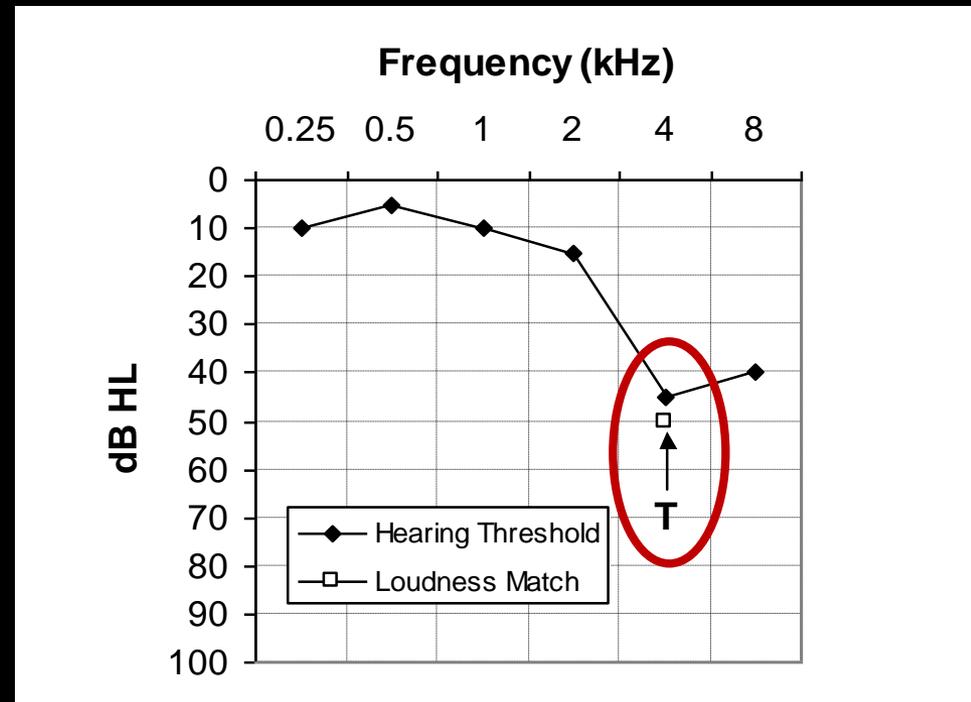
- *“....not routinely recommended, as these results are not helpful for diagnostic purposes, for guiding intervention, or for assessing outcomes of intervention. These measures typically include tinnitus loudness and pitch matching, minimum masking levels, and residual inhibition testing.”*  
(p. S14)

# Value of Tinnitus Psychoacoustic Testing?

- *Diagnostic? Prognostic?*
- *Determine treatment parameters?*
- *Assess outcomes?*
- Although clinical value of these measures is equivocal, they currently are used most commonly as a counseling tool – patients may feel validated that their tinnitus percept can be “quantified” (and plotted on audiogram)

# Plotting the Tinnitus Match on the Audiogram

- “Validates” tinnitus perception
- Points out that tinnitus is a “faint signal” even though it seems “loud”



# Caveat

- If the intended outcome of intervention is reduced reactions, psychoacoustic testing can keep patient focused on how sound affects the perception of tinnitus
  - Could make it harder for patient to switch to the goal of reducing reactions without changing the tinnitus

# Tinnitus Loudness (intensity/magnitude)

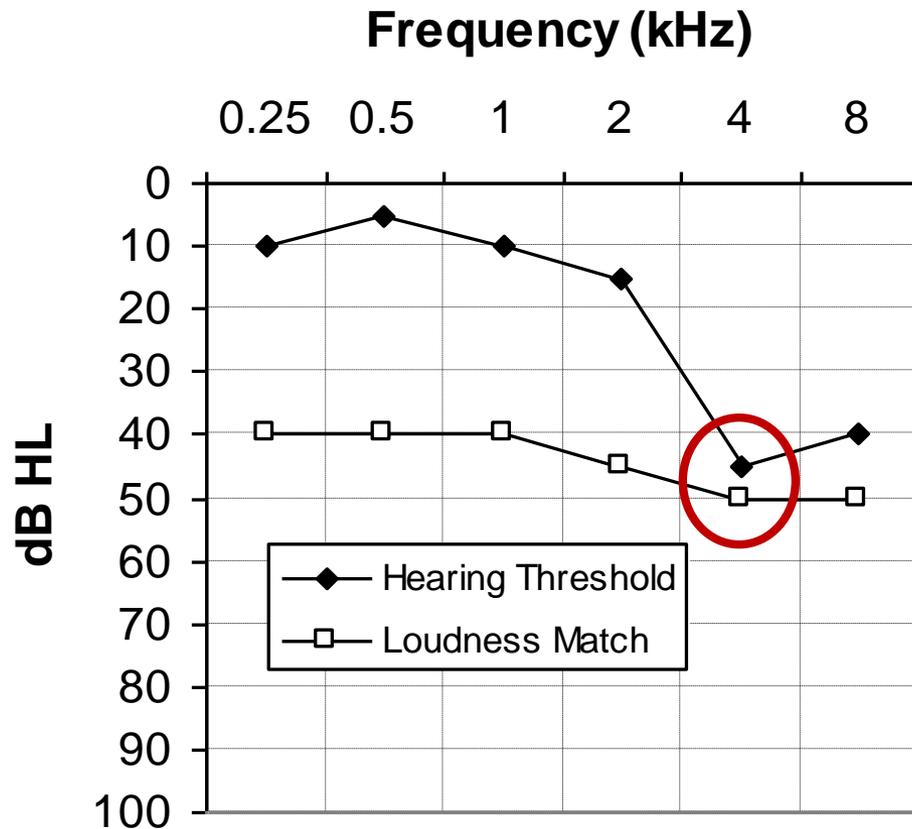
- **Clinically, the most important attribute**
  - Reducing the loudness of tinnitus would provide therapeutic benefit for most people



# Tinnitus Loudness Matching

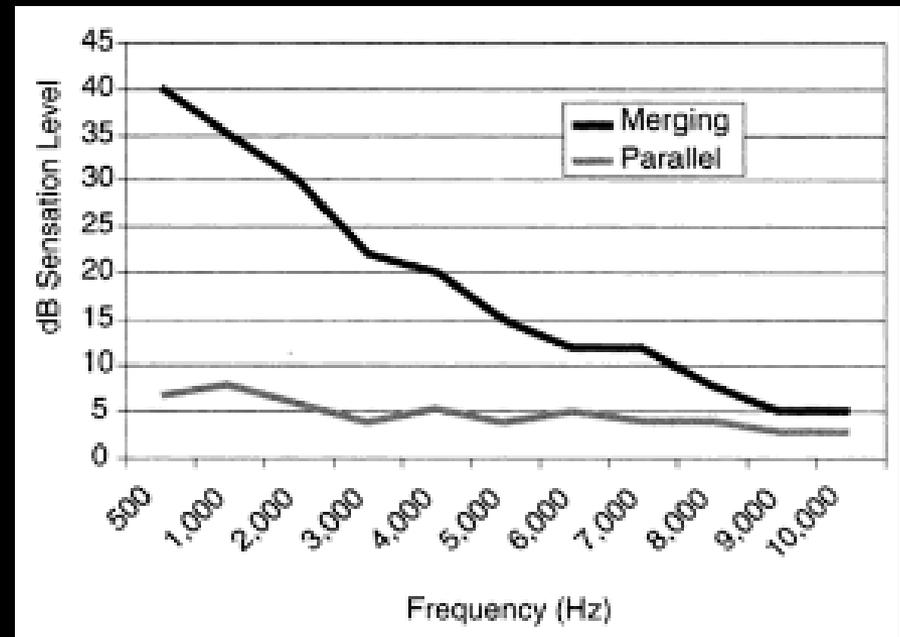
- Present stimulus to patient's ear
- Ask if stimulus is “louder or softer” than tinnitus
- Adjust level of stimulus until patient reports tinnitus and tone are equal loudness

# Are Loudness Matches “Paradoxically Small”?



# Loudness Matches are Reliable

- Even if matching tone does not sound “at all” like the tinnitus
- Reliable loudness-match *functions*
- Reliable both within and between sessions

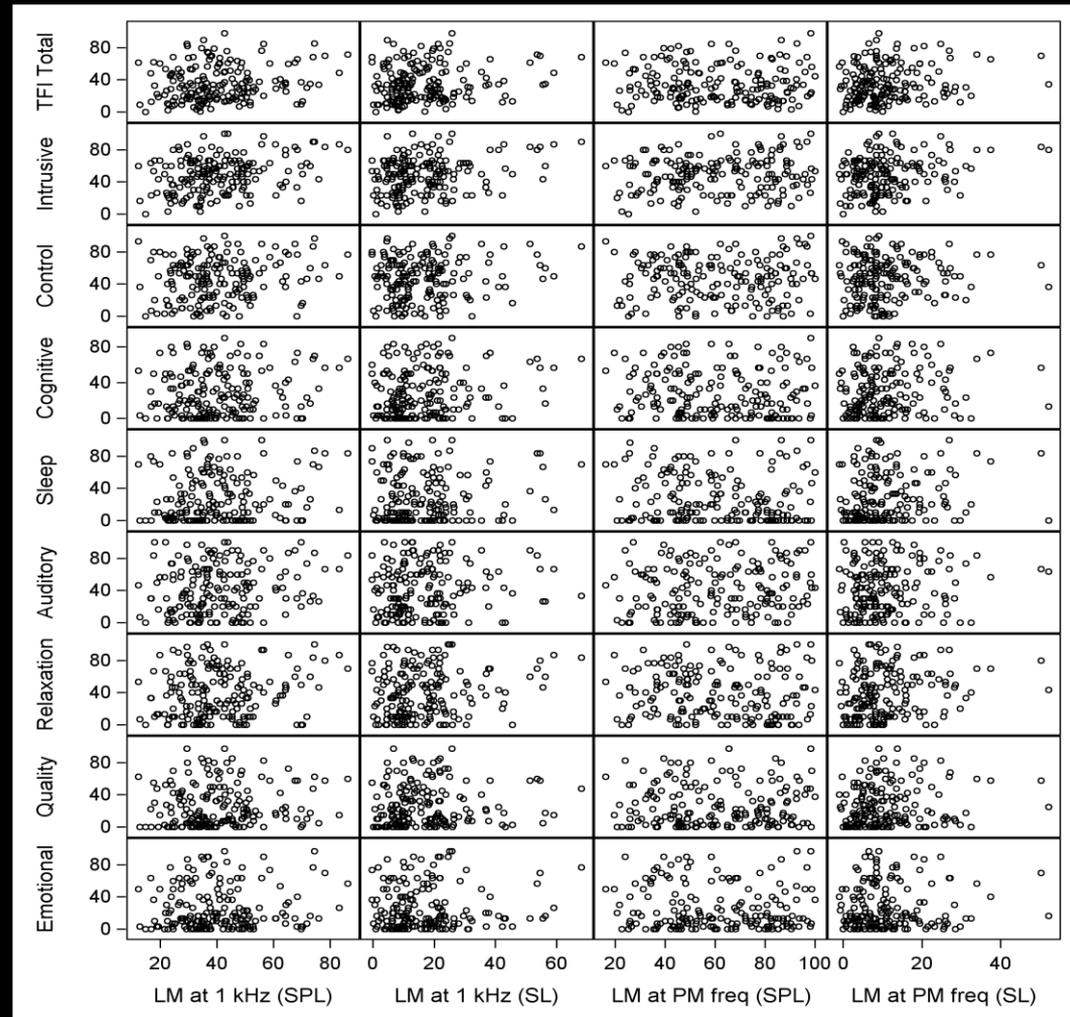


Henry JA. Audiological assessment of the tinnitus patient. In JB Snow (Ed.), *Tinnitus: Theory and Management*. Lewiston, NY: BC Decker Inc., pp. 220-236, 2004.

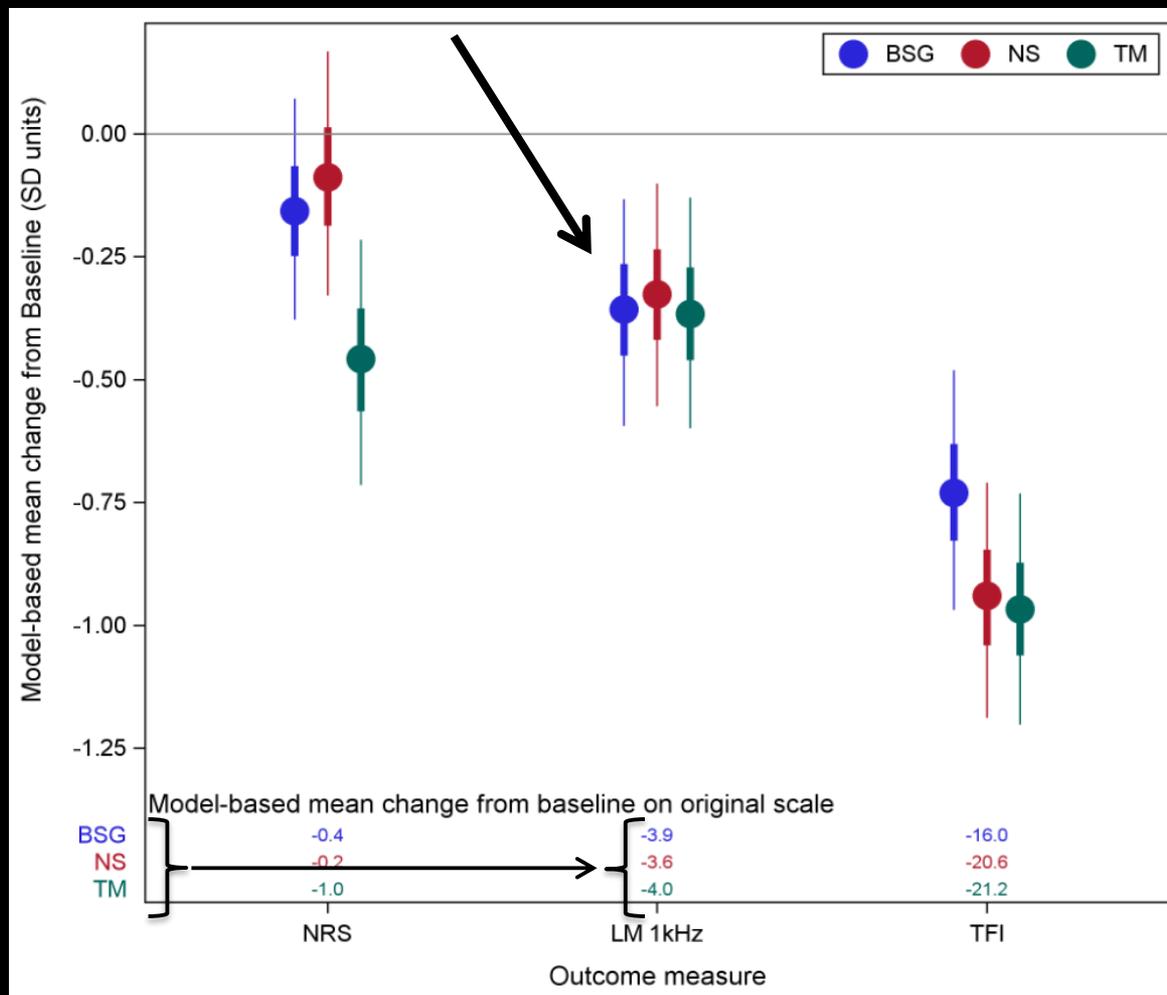
# Loudness Matches do not Correlate with Measures of Tinnitus Impact

	LM at 1 kHz (SPL)	LM at 1 kHz (SL)	LM at PM freq (SPL)	LM at PM freq (SL)
<b>TFI Total</b>	0.17	0.16	-0.01	0.17
<b>Intrusive</b>	0.30	0.26	0.11	0.26
<b>Control</b>	0.17	0.16	0.02	0.10
<b>Cognitive</b>	0.12	0.15	-0.09	0.14
<b>Sleep</b>	0.11	0.11	-0.10	0.16
<b>Auditory</b>	0.17	0.10	0.14	0.12
<b>Relaxation</b>	0.16	0.20	-0.08	0.20
<b>Quality</b>	0.08	0.06	0.01	0.12
<b>Emotional</b>	0.05	0.05	0.07	-0.07

Pearson correlation coefficients between TFI total score and subscales vs. measures of tinnitus loudness. Baseline visit data from N=179 participants.



# Reduced Tinnitus Loudness Following Treatment?



Theodoroff SM, McMillan GP, Cheslock M, Roberts C, Zaugg T, Henry JA. Randomized controlled trial of a novel device for acoustic treatment of tinnitus during sleep. *American Journal of Audiology.* (in press)

# *Can Tinnitus Loudness Matches be Used as an Outcome Measure?*

- Need normative standards
  - *What is the normal variability of LMs?*
    - Over time, and without treatment
  - *How much of a change in LM would reflect a perceived change in tinnitus loudness?*

# Constrained Loudness Scaling

- Ward and Baumann (2009) developed to produce more meaningful measures of tinnitus loudness
- Training: present 1-sec, 1000-Hz tone at 17 intensity levels
  - Choose number from 1-44 to indicate each tone's loudness
  - After each choice, computer displays “standard” number assigned to that level (“calibrates” listener to constrained loudness scale)
- Judgments: using the same scale, listener judges the loudness of tinnitus, and loudness of a tone representing the dominant tinnitus pitch

# Constrained Loudness Scaling

Instructions

Enter a number from 1 to 44 to rate how loud this sounds (1 is softest and 44 is loudest), then press NEXT to continue.

Your loudness estimate

15

Loudness rating (1 to 44)

1

2

3

4

5

6

7

8

9

Back

0

Clear

NEXT

Instructions

Compare your answer with the actual loudness value, then press NEXT to continue.

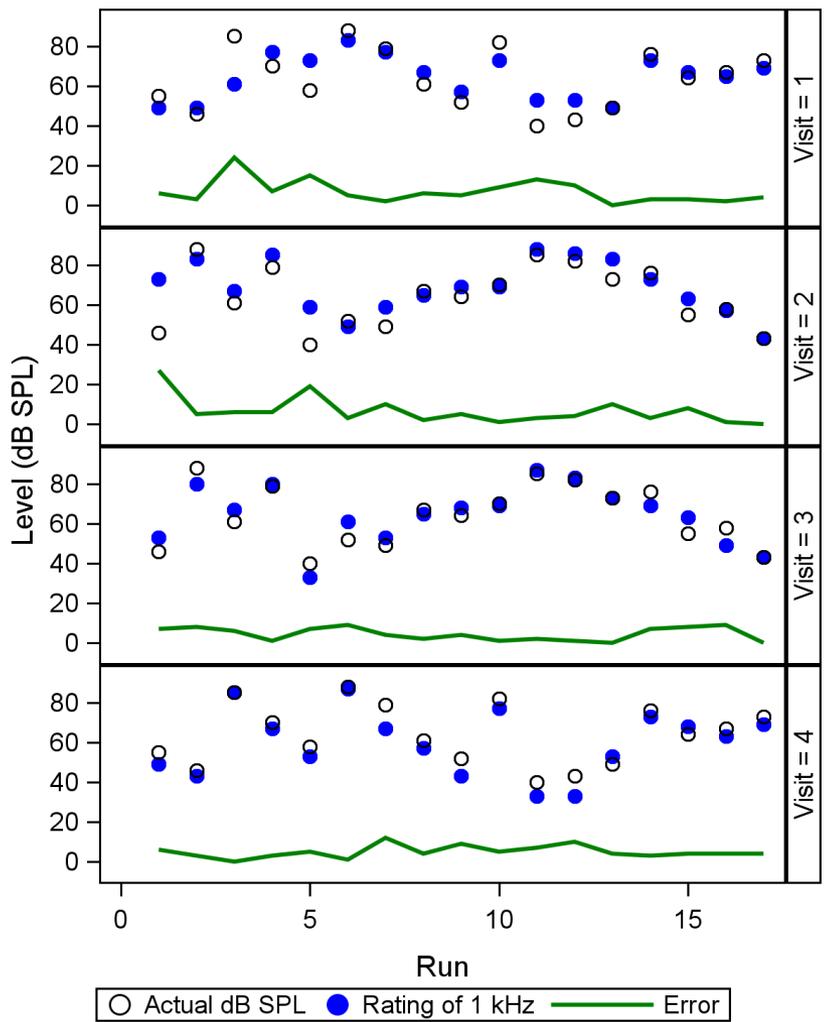
Your loudness estimate

15

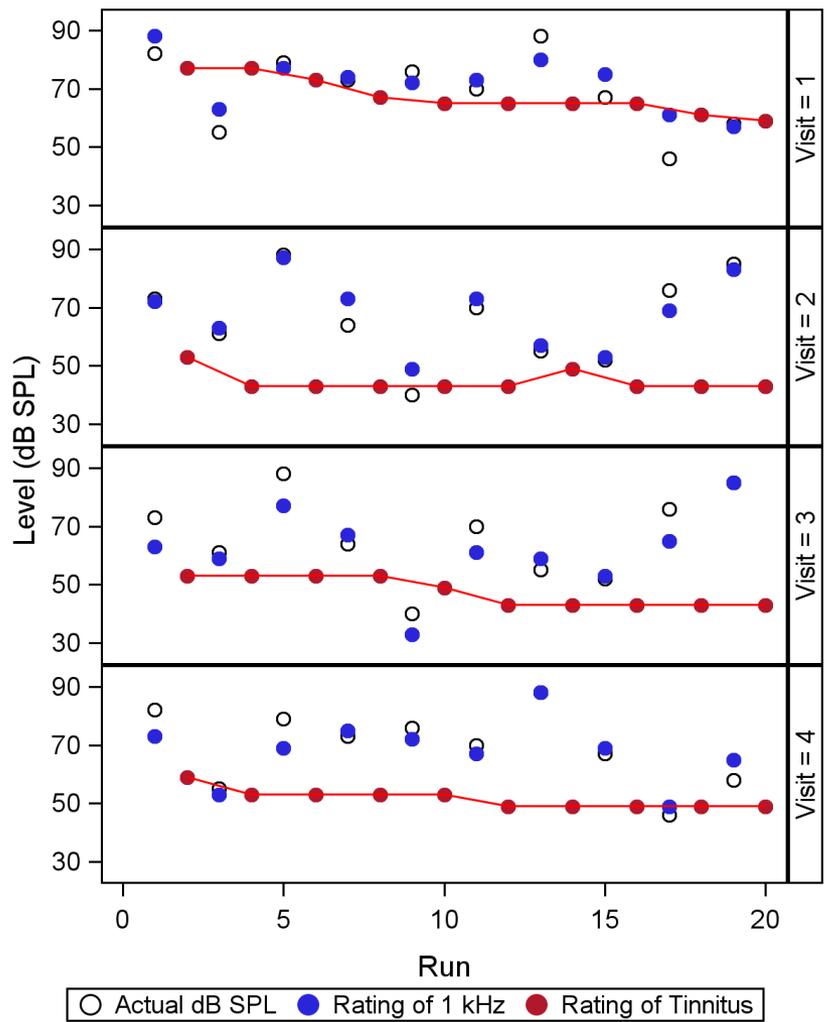
Actual loudness

12

NEXT



“Practice” run of 17 trials indicating one participant’s rating (dB SPL) of 1 kHz tone according to constrained loudness scale over 4 visits



One participant’s rating (dB SPL) of 1 kHz alternating with rating (dB SPL) of tinnitus loudness, utilizing the learned constrained loudness scale, over 4 visits



Manning C, Thielman E, Zaugg T, Gordon S, Grush L, Henry JA. “Tinnitus Loudness Measurement Using Constrained Loudness Scaling.” Department of Defense, Hearing Center of Excellence, 2016 Annual Collaborative Auditory Vestibular Research Network (CAVRN) Meeting, U.S. Army Aeromedical Research Laboratory (USAARL), Ft. Rucker, AL, May 17-19, 2016. (poster)

# Tinnitus Loudness Ratings

- Numerical scale



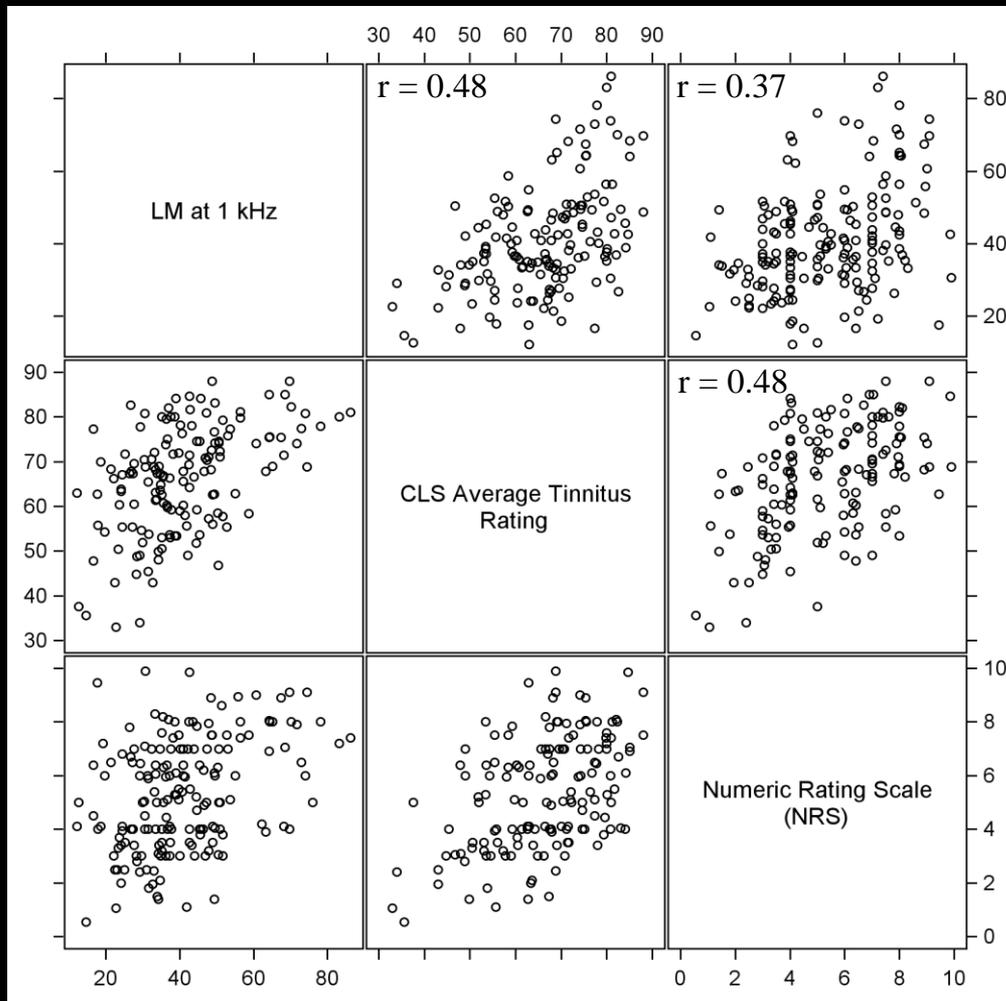
- Visual analog scale



# *Clinical Value of Loudness Ratings?*

- Ratings confounded by effects of tinnitus
  - Patients often rate tinnitus loudness with respect to how *bothersome* it is
- Ratings correlate positively with outcomes
  - Patients who show improvement tend to also show reduced loudness ratings

# Scatterplot Matrix of Loudness Measures



Scatterplots of Loudness Match (LM) at 1 kHz in dB SPL, Constrained Loudness Scaling (CLS) average tinnitus rating in db SPL and NRS. Baseline visit data from N=120 participants. Pearson correlation coefficients are shown as r values.

Manning C, Grush L, Thielman E, Faucette S, Henry JA. "Reliability of Tinnitus Loudness Measures: Matching, Rating, and Scaling." Annual Scientific and Technology Conference of the American Auditory Society, Scottsdale, AZ, March 2-3, 2017. (poster)

# Overall Summary of Tinnitus Loudness Measures

- Can't objectively quantify tinnitus loudness
- LM may be helpful for counseling (recall caveat)
- LM may have value as an outcome measure if it can be proven that changes in tinnitus loudness can be quantified by corresponding LM changes
  - CLS may show value
- Loudness scaling may reflect more how bothered a person is by tinnitus than actual loudness of tinnitus



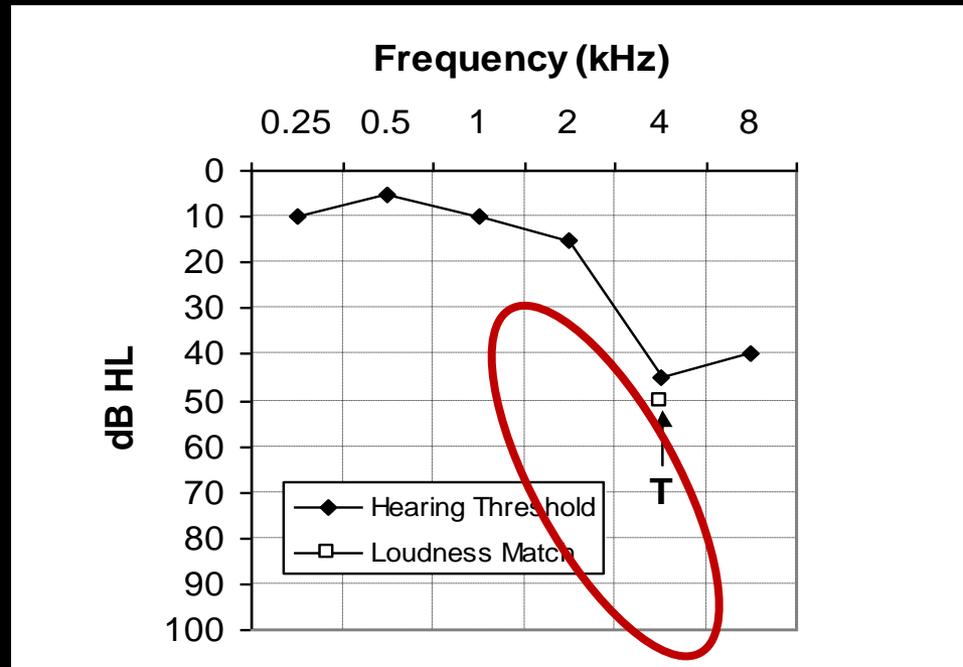
# Tinnitus Pitch Matching

- Standard measure of tinnitus pitch
  - Frequency of tone is varied; patient selects tone that matches pitch of tinnitus
- Should be straightforward, but it's not

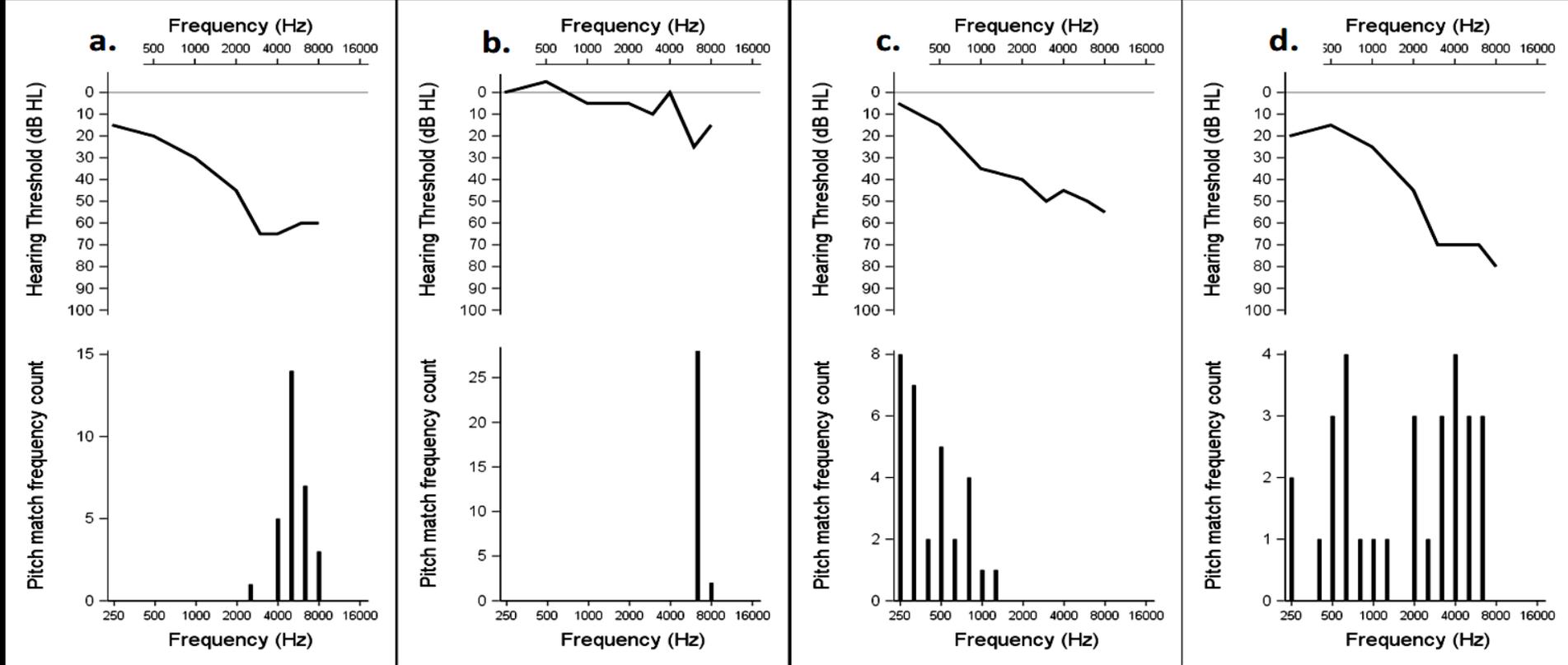


# “Typical” Pitch Matches

- High frequency (>3 kHz)
- *Occur most often on slope of audiogram, or in region of maximum hearing loss?*



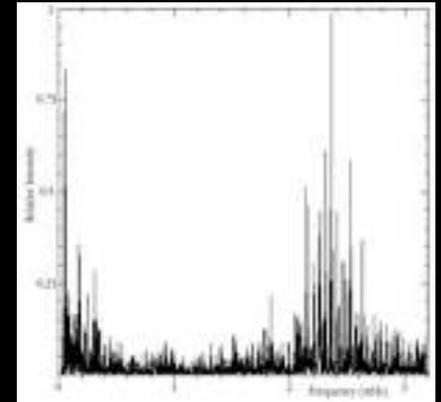
Audiograms and PM frequency histograms for selected participants. Some participants selected PMs more often in frequency regions with a greater degree of hearing loss (a,b). However, many did not follow this pattern, for example, selecting PMs in regions with relatively good hearing (c) or selecting rather evenly across a broad range of frequencies (d).



Manning C, Thielman E, Grush L, Henry JA. "How are Tinnitus and Hearing Loss Related? Comparing the Audiogram and Tinnitus Psychoacoustic Measures." 2017 Annual Collaborative Auditory Vestibular Research Network (CAVRN) Meeting, San Antonio, TX. June 13-15, 2017. (poster)

# *Are Pitch Matches Reliable?*

- **No!**
- Possible reasons:
  - Patients have difficulty with PM task
  - Matching tone sounds more like noise due to hearing loss
  - Tinnitus is likely a spectrum of sounds



# Poor Reliability of Pitch Matches Can Confound “Auditory Training”

- Auditory training: various attempts to modify tinnitus with auditory stimuli
  - Pitch match informs stimulus design
- Single PM reflects some frequency within 2-3 octave range
- Calls into question validity of these methods

# Bayesian Method of Pitch Matching

- Approach: retain standard pitch matching protocols and combine several PMs to more accurately estimate tinnitus frequency

McMillan GP, Thielman E, Wypych K, Henry JA. A Bayesian perspective on tinnitus pitch matching. *Ear and Hearing* 35(6):687-694, 2014.

# Rationale for Combining Several Pitch Matches for Estimating Tinnitus Frequency

- More PMs enhances the precision with which tinnitus frequency is estimated and, assuming that the PMs are unbiased, improves the accuracy of the estimate
- *How many PMs are needed?*
  - Depends on the desired level of precision—many more required if therapeutic protocol requires, e.g., an estimate that is within  $1/48^{\text{th}}$  octave than only within 1 octave of the true tinnitus frequency
  - Also depends on patient's reliability in accomplishing the task
- There is no all-purpose sample size recommendation suitable for all patients, because the achieved precision of the tinnitus frequency estimate in a particular patient depends on that patient's *a priori* unknown reliability

Estimate type	Average within-subject SE of estimates across visits	Average within-subject range of estimates across visits	Average length (min)	Average number of runs
Bayesian	627.8	2752.0	3.3	14.0
Mean 30	632.6	2789.7	7.1	30.0
Mean 10	683.2	3008.4	2.4	10.0
Mean 5	706.0	3076.1	1.2	5.0
First PM	1048.5	4490.4	0.2	1.0
FCDS				
Average	1892.8	8133.3	3.9	34.3

# Summary of Tinnitus Pitch Matching

- PMs tend to occur on edge or middle of hearing loss region – but not always
- PMs are notoriously unreliable—used anyway to adjust sound therapy devices
- Need to improve precision of PMs – Bayesian approach may offer a solution

# Effects of Sound on Tinnitus

- Masking/suppression effects
- Residual inhibition
- Exacerbation
- Alteration (?)

# Minimum Masking Level (MML)

- *Objective:* determine lowest level of BBN that renders tinnitus inaudible (completely “masks” tinnitus)

# Different Levels of Tinnitus “Masking”

## Complete Masking

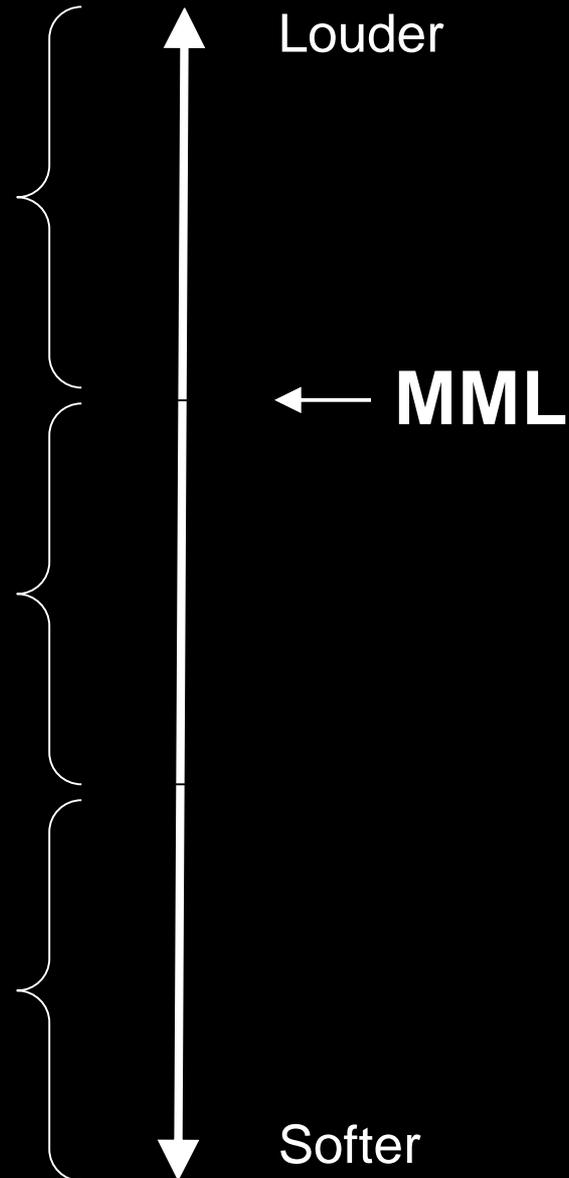
- Complete elimination of tinnitus percept

## Partial Masking

- Spectral changes in tinnitus sound  
**AND/OR**  
• Reduced perception of tinnitus loudness

## No Masking

- No change in perception of tinnitus



# *Are MMLs Correlated with Tinnitus Impact (and Changes in Impact)?*

- Some evidence
  - Jastreboff (1994)
  - *Other studies?*
  - NCRAR data

# NCRAR LM & MML Baseline Correlations with THI

		THI Total	THI Functional	THI Emotional	THI Catastrophic
LM	Correlation Coefficient	-.035	-.036	-.012	-.050
	Sig. (2-tailed)	.760	.751	.919	.658
	N	81	81	80	81
MML RE	Correlation Coefficient	.417	.275	.467	.534
	Sig. (2-tailed)	.000	.024	.000	.000
	N	67	67	66	67
MML LE	Correlation Coefficient	.348	.233	.387	.498
	Sig. (2-tailed)	.003	.055	.001	.000
	N	69	69	68	69

# 0-12 mo Difference Scores: LM & MML vs. THI

		THI Total	THI Functional	THI Emotional	THI Catastrophic
LM	Correlation Coefficient	.008	-.024	.090	-.069
	Sig. (2-tailed)	.947	.837	.435	.550
	N	78	78	77	78
MML RE	Correlation Coefficient	.202	.194	.218	.291
	Sig. (2-tailed)	.115	.132	.091	.022
	N	62	62	61	62
MML LE	Correlation Coefficient	.185	.153	.215	.315
	Sig. (2-tailed)	.151	.236	.097	.013
	N	62	62	61	62

# Residual Inhibition

- Definition: “*Tinnitus perception is reduced in intensity, or eliminated altogether, following auditory stimulation*”
  - Tinnitus *can* get louder
- Clinical procedure developed that demonstrates RI in up to 80-90% of patients
- RI reported to last <2 min in 60% of patients; <4 min in 80% (Meikle et al., 2004)

# “Measurement” of Tinnitus: Research Needed

- Develop methods to:
  - Objectively quantify tinnitus loudness
  - Obtain repeatable measures of tinnitus pitch
  - Describe the spectrum of tinnitus
  - Use residual inhibition as a clinical technique
  - Use auditory training procedures to suppress tinnitus long-term

# Measuring Tinnitus *Reactions*

# Measuring *Reactions* to Tinnitus



- Determining where a patient would be placed on the continuum from nonbothersome to debilitating tinnitus requires:
  - Appropriate instruments
  - Proper timing for administering those instruments
- Numerous tinnitus questionnaires (at least 12?) validated for intake assessment

## *Which Questionnaire Should I Use?*

- *Tinnitus Handicap Inventory?*
- *Tinnitus Questionnaire?*
- *Tinnitus Reaction Questionnaire?*
- *Tinnitus Handicap Questionnaire? Other?*
- Recommend (bias alert): *Tinnitus Functional Index*
  - Validated for “responsiveness”
  - Eight subscales/domains of tinnitus distress

# Blaming Tinnitus for Hearing Difficulties

- Ratnayake et al 2009 systematically studied the relationship between complaints of hearing loss and complaints of bothersome tinnitus
- Conclusion: *“In tinnitus subjects, the awareness of impaired hearing may in fact be due to an underlying hearing loss rather than their tinnitus. In these cases, the impairment of hearing may contribute significantly to the perceived distress caused by the tinnitus.”*

# *Is “Bothersome Tinnitus” Actually “Bothersome Hearing Loss”?*

- Typical confusion for patients with both hearing loss (unaided) and bothersome tinnitus
  - Such people tend to respond to questions about effects of tinnitus with respect to their hearing problems
- Our solution: *Tinnitus and Hearing Survey*

## Tinnitus and Hearing Survey

*A. Tinnitus problems not confused with hearing problems*

*B. Hearing problems not confused with tinnitus problems*

*C. Screen for sound tolerance problems*

### A. Tinnitus

Over the last week, tinnitus kept me from sleeping.

No, not a problem	Yes, a small problem	Yes, a moderate problem	Yes, a big problem	Yes, a very big problem
-------------------	----------------------	-------------------------	--------------------	-------------------------

0	1	2	3	4
---	---	---	---	---

Over the last week, tinnitus kept me from concentrating on reading.

0	1	2	3	4
---	---	---	---	---

Over the last week, tinnitus kept me from relaxing.

0	1	2	3	4
---	---	---	---	---

Over the last week, I couldn't get my mind off of my tinnitus.

0	1	2	3	4
---	---	---	---	---

Total of each column

Grand Total

### B. Hearing

Over the last week, I couldn't understand what others were saying in noisy or crowded places.

0	1	2	3	4
---	---	---	---	---

Over the last week, I couldn't understand what people were saying on TV or in movies.

0	1	2	3	4
---	---	---	---	---

Over the last week, I couldn't understand people with soft voices.

0	1	2	3	4
---	---	---	---	---

Over the last week, I couldn't understand what was being said in group conversations.

0	1	2	3	4
---	---	---	---	---

Total of each column

Grand Total

### C. Sound Tolerance

Over the last week, sounds were too loud or uncomfortable for me when they seemed normal to others around me.\*

0	1	2	3	4
---	---	---	---	---

*If you responded 1, 2, 3, or 4 to the statement above:*

Please list two examples of sounds that are too loud or uncomfortable for you, but seem normal to others:

\_\_\_\_\_

\_\_\_\_\_

\*If sounds are too loud for you while wearing hearing aids, please tell your audiologist.

For office use only (II):  M  H  N

Henry JA, Zaugg TL, Griest S, Thielman E, Kaelin C, Carlson KF. Tinnitus and Hearing Survey: A screening and assessment tool to differentiate bothersome tinnitus from hearing difficulties.

*American Journal of Audiology* 24(1):66-77, 2015.

# 4. Clinical Recommendations

# 1. Conduct audiologic evaluation with *every* patient who reports tinnitus

- 80-90% of people with tinnitus have hearing loss
- Conduct routine audiologic exam plus brief assessment of tinnitus
  - Tinnitus questionnaires can exaggerate tinnitus problem – *Tinnitus and Hearing Survey* suggested

Combined results will, in most cases, provide sufficient information to know if the patient requires tinnitus-specific intervention

## 2. Collaborate with patients to assist in making decisions re: intervention

- Patients should be *empowered* to make their own decisions
  - Clinicians provide *evidence-based* information to facilitate decision-making
- Offer specific intervention with reasonable expectations

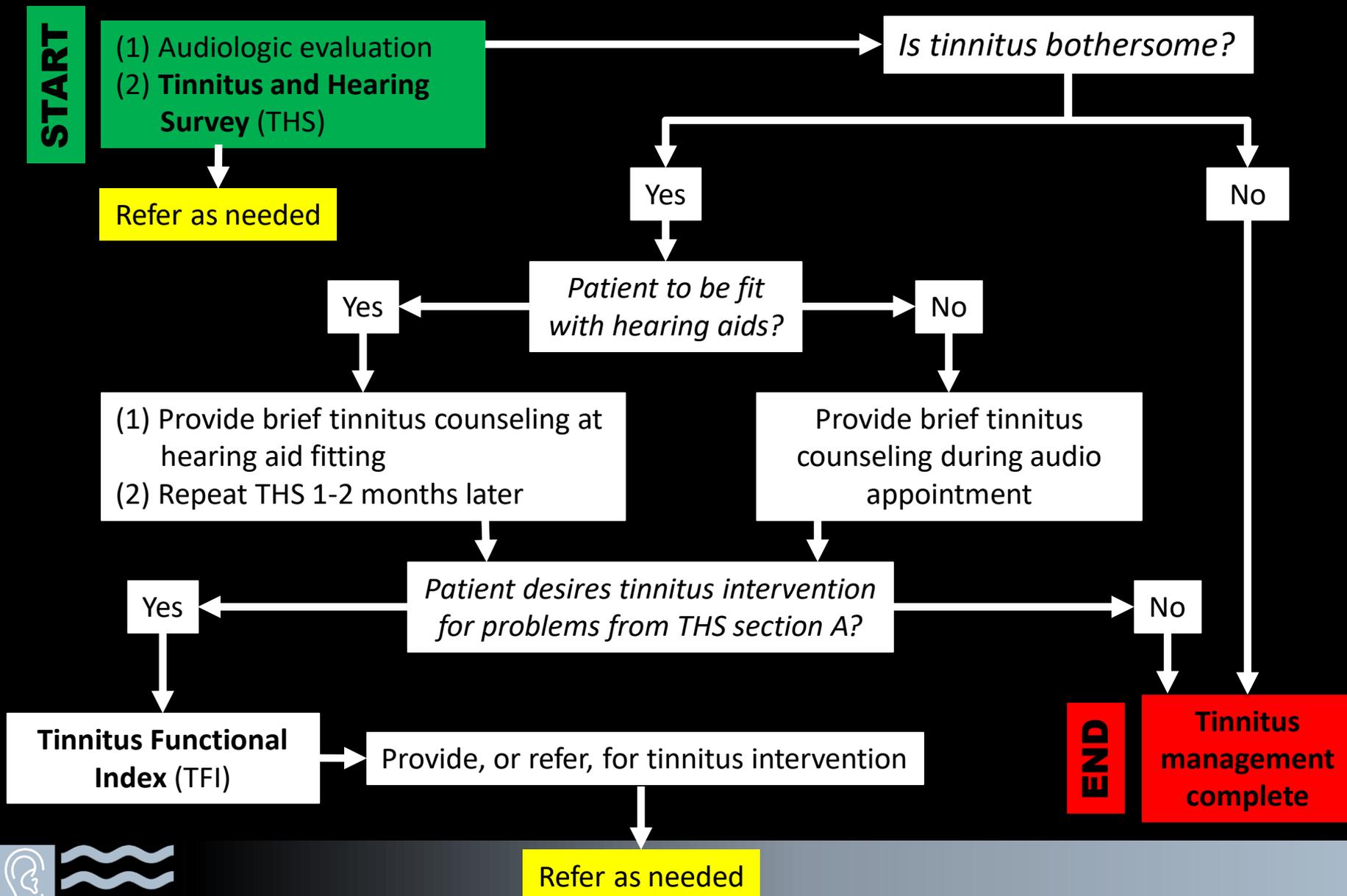
3. Use outcome questionnaire only when tinnitus-specific intervention will be received

- Patients who blame their tinnitus for their hearing problems will provide inflated scores on tinnitus questionnaires

## 4. Do follow-up assessment ~6 weeks following intervention

- Purpose: determine if further services are needed/wanted
  - PTM has follow-up questionnaires specifically for this purpose

# Flowchart for Audiologic Management of Patients Reporting Tinnitus



# Bottom Line: Tinnitus Management Essential Components

- Assessment
  - Hearing evaluation plus *Tinnitus and Hearing Survey*
  - Refer appropriately to ENT and Mental Health
  - Outcome questionnaire only if intervention received
- Intervention
  - Hearing aids/combination instruments
  - Self-help education
    - Self-care skills (CBT optimal)
    - Sound-based therapy
- Follow up

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## VA RR&D Service

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